Waves Measurement Requirements per AO Objectives: Drivers on Waves Data Rates

1.1.a-2
3-dimensional electromagnetic wave fields must be measured at frequencies ranging from TBD to TBD. Measurements must enable identification of wave populations that interact with radiation belt electrons including VLF Hiss, whistler chorus, and EMIC waves. Statistical spatial distributions of those waves must be determined. Time resolution for full spectra must be as high as practical and no greater than one spin.

1.1.a-3
same as 1.1a-2 plus waveform, spectral, and frequency resolution that enable determination of critical characteristics such as wave normal angle (k)

1.1.d-1
Measure wave fields to determine if interplanetary shocks produce or alter other wave populations in the inner magnetosphere.

2a-1
3D vector E and B frm 10 hz to 12 kHz. Routine spectra, wave normal, Poynting flux at 6 s cadence. Chours with 30 ms resolution.

2a-2
3D vector E and B frm 10 hz to 12 kHz. Routine spectra, wave normal, Poynting flux at 6 s cadence. Chours with 30 ms resolution.

3c-3
Survey wave properties in the range from 10 Hz to 12 kHz, including spectrum, polarization, propagation properties. Additionally, provide occasional high temporal resolution for bursty emissions such as chorus.

3e-1,2,3,4
Survey wave properties in the range from 10 Hz to 12 kHz, including spectrum, polarization, propagation properties. Additionally, provide occasional high temporal resolution for bursty emissions such as chorus.

4Q-1b
Measure the 3 D wave magnetic field variation over the amplitude range from TBD nT to 4 nT over the frequency range between 100 Hz to 10 kHz. Measure wave electric fields over same frequency intervals. Wave normal direction from minimum variance. For electrostatic waves need 3-d electric fields for k wave normal. Need phase velocitity, coherence. Spatial scale sizes interferometrically for 10 m to 10 km. timing wth phase velocities utp 1000 km/s. Burst wave form for assessing above properties with wave form information.

4Q-1c,d
Measure background density by determining frequency of plasma line using E field spectra from 10 kHz to 500 kHz (1-2500 cm-3) Sensitivity TBD at a cadence of once per minute. INCLUDE MEASUREMENTS FROM ABOVE. Requires intervals of burst wave form data.

4Q-2c
same as 4Q-1

4Q-5b
same as 4Q-1

5c-2
Survey E and B wave properties in the range from 10 Hz to 12 kHz, including spectrum, polarization, propagation properties, 6 s resolution. Additionally, provide occasional high temporal resolution for bursty emissions such as chorus.

5d-2
same as 5c-2

5e-2
same as 5c-2

6c-1
Wave data (TBD specification); 30msec resolution for Chorus

7b-1,3
Plasma frequency meausrement

7f-3,4
Plasma frequency meausrement
Need swept frequency receiver frequency range up to 400 kHz (1600/cc)

8b-2
3D wave electric field:300 mv/m to 0.01mV/m @1 Khz, TBD range > 1 kHz; 3D wave magnetic field TBD range over 10 Hz to 10 kHz . [The full range of frequencies and amplitudes effecting particle dynamics.] VLF wave data could be a critical model driving parameter.

8c
same as 8b-2

8d
same as 8b-2

Driving Requirements
(Note: where requirement appears in multiple objectives, only one objective is cited.)

Number of components: 3 E, 3 B (Objective 2a)

Frequency Range (EMIC, VLF Hiss, Chorus): 10 Hz to 12 kHz (Objective 2a)

Temporal resolution for spectra: must be as high as practical and no greater than one spin (Objective 1-1a-2) (interpret as 1 to 12 seconds)

Spectral resolution (EMIC, VLF hiss, chorus): 20 channels/decade (delta-f/f ~12%) (Assumed, from 1-1a-3)

Temporal resolution for chorus spectrum, wave normal, Poynting flux, etc.: 30 msec (Objective 2a) (this drives the requirement for extended burst mode data)

Frequency Range (for density determination): 10 kHz - 500 kHz (Objective 4Q-1c)

Spectral resolution (for density determination): 50 channels/decade (delta-f/f ~5%) provides ~10% density resolution (assumed requirement)